INCASE

Irish Natural Capital Accounting for Sustainable Environments

IRISH NATURAL CAPITAL ACCOUNTING FOR SUSTAINABLE ENVIRONMENTS

Feasibility report

March 2020

EPA Research Programme 2014–2020

IRISH NATURAL CAPITAL ACCOUNTING FOR SUSTAINABLE ENVIRONMENTS:

STAGE 1 FEASIBILITY REPORT

Prepared for the Environmental Protection Agency as part of the INCASE project

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Main authors:

Catherine A. Farrell and Jane C. Stout

Co-authors included members of the INCASE Project Team and Steering Committee:

INCASE Project Team:

- WP1/2/3/4   Jane Stout and Catherine Farrell, TCD
- WP2:   Mary Kelly-Quinn and Siobhan Atkinson, UCD
- WP1/2/3:   Mark Eigenraam and Carl Obst, IDEEA Group
- WP3:   Cathal O'Donoghue, UCG; Stephen Kinsella, UL
- WP4:   Orlaith Delargy, IFNC

INCASE Project Steering Committee

Paddy Morris, EPA Catchments Unit ; Donal Daly (retired EPA Catchments Unit); Gemma Weir, National Parks and Wildlife Services; Gerry Brady, Central Statistics Office; John O'Neill, Dept Communications, Climate Action and Environment; Paola Ovando, Hutton Institute, Scotland; Walter Radermacher, Sapienza University of Rome.

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Executive summary

> **KEY MESSAGE**: This interim report (February 2020) has been developed at the request of the EPA to review the rationale and direction of the INCASE project. It is written to reflect the work of the INCASE Project Team completed to date (March 2019-February 2020), specifically in reviewing natural capital accounting approaches, data requirements for the project, catchment selection, potential applications and feasibility.

Identifying Pressures

The natural world we live in underpins human existence. It can be thought of as our *stock* of natural capital that yields *flows* of goods and services. These goods and services include the basic requirements of daily living – food, water, clean air, etc. Ensuring those services continue to flow for this generation and future generations is one of the fundamental aspects of sustainable development and the keystone of social and economic welfare.

In the Irish context, the EPA State of the Environment Report (EPA SOER, 2016) highlights the need to integrate natural capital accounting (NCA, also referred to as *Green Accounting*) into our measures of prosperity so that we can track and measure our performance alongside related issues such as wellbeing and environmental health. Data behind natural capital accounts, as demonstrated in other countries such as the UK and Netherlands, serve as a standardised data platform that can be used in a multi-disciplinary way. NCA can be used to identify trends in the quality of the environment, inform trade-offs, identify co-benefits, establish critical links between natural and other capitals (such as built and social capital) as well as identifying knowledge gaps. Such an approach will help us to understand and, combined with the use of other appropriate tools, address the dominant pressures and their impacts - climate change, growth in human population, continued degradation of nature - on Ireland's environment.

The INCASE (Irish Natural Capital Accounting for Sustainable Environments) research project aims to apply NCA at a pilot (catchment) scale in Ireland. Significant pressures on *At Risk* water bodies are well defined at catchment level by the EPA, with agriculture identified as the most significant pressure in the River Basin Management Plans 2018-2021. Recent EPA reports in December 2019 indicate that water quality in Ireland continues to decline[1].

Developing natural capital accounts at catchment scale will inform how the accounts (asset extent, condition, supply and use of services, benefits, etc.) can be built using Irish data sources and provide valuable lessons on how best to scale up to the national level. INCASE will explore how NCA can be used to identify solutions either through investing in and renewing degraded natural capital stocks and flows (improving water quality, restoring ecosystems, etc.) and/or changing management practices and incentive schemes (for example developing Payment for Ecosystem Services). Linking biophysical information (maps with qualitative and quantitative data) with economic data, the project will also explore how natural capital accounts can be used to develop better metrics for national accounting. Pioneering methods tested and refined at catchment level by INCASE, will contribute to scaling up to national level, delivering effective and efficient use of project outputs to be of immediate use to policy makers. Developing a system of NCA fit for purpose will require addressing a range of challenges from high level epistemological ones (*can nature fit into accounting methods?*) to practical data sharing and quality issues.

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[1] http://www.epa.ie/newsandevents/news/pressreleases2019/name,67351,en.html

Policy

The new European Green Deal published at the end of 2019[2] specifically aims to protect, conserve and enhance Europe's natural capital, and protect health and wellbeing from environment-related risks and impacts. The Green Deal states that: *all EU policies should contribute to preserving and restoring Europe's natural capital*. In addition, the development of standardised natural capital accounting (NCA) practices is explicitly mentioned as part of the range of initiatives to pursue green finance and investment.

In Ireland, the Climate Action Plan published in 2019 sets a number of targets and highlights the need for an integrated approach to land use, taking into consideration the changing role and trends of sectors such as agriculture, forestry and energy in Ireland. Extending this to the marine will be necessary to deliver on policy and plans for both land and sea. NCA is one of the tools that can help to integrate a range of sectoral policy targets (relating to nature, environment, land use, society and economy) and decision making and align them with over-arching Sustainable Development Goals (SDGs). Some preliminary work has been done on NCA under the EU Mapping and Assessment of Ecosystem Services project (NPWS, 2016) and the CSO is mandated by the EU to report a number of environmental accounts to Eurostat since 2011[3]. Other national level plans that refer to natural capital include the National Development Plan and National Planning Framework (2018).

Following from emerging EU and national policy, NCA will be mandatory in coming years and building the best approach and fit for the local, Irish context is essential. The INCASE Project forms part of the network of EU and global projects (over 80 countries are engaged with NCA) that is working towards refinement and further development of NCA methods. As part of this network, Ireland is well placed to contribute to and lead in terms of the refinement of the process at national and EU levels. The potential uses and benefits of NCA include:
- Allowing for different sectors to communicate on a common data platform;
- Facilitating shared understanding;
- Informing better decisions around terrestrial and marine use; as well as
- Working towards better indicators of sustainable development.

Solutions – accounting for nature

Natural Capital as a concept brings discussions around nature and its contributions to human wellbeing, into the language of traditional accounting and reporting. The underpinning concepts are nature (everything that occurs naturally – abiotic and biotic components) and capital (stocks or assets). In order to bring nature into an accounting system, a standardised approach must be developed to define what we are accounting for. This requires an understanding of what natural capital assets (ecosystems, geosystems and atmospheric systems) are, how they work, how they can be mapped and defined, and how they provide benefits to humanity[4]. Having a standardised accounting approach, based on principles set out in other accounting approaches such as the System of National Accounts (SNA), allows for repeatable, comparable datasets which can monitor changes over time, informing better indicators and/or metrics of sustainable use.

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[2] https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf
[3] A list of environmental accounts collated by CSO (2020) are outlined in Appendix I. These accounts became mandatory with the introduction of Regulation (EU) 691/2011 though the CSO has already developed a number of accounts as part of a Eurostat pilot project in advance of Regulation (EU) 691/2011.
[4] This is the fundamental approach to NCA – mapping the extent and condition of natural capital assets (stocks) and identifying the services that flow (provisioning, regulating, supporting and cultural etc.) from those stocks. Identifying benefits and beneficiaries is also a key aspect.

The UN System of Environmental-Economic Accounting framework (SEEA) is the most widely used and considered best practice approach to NCA. The SEEA (the basis of the OECD definition of *Green Accounting)* incorporates two aspects – the SEEA-Central Framework and the SEEA-Experimental Ecosystem Accounting:

- The SEEA-CF covers physical accounts and flows of environmental assets (such as water), and monetary accounts (environmental transactions).
- The SEEA-EEA follows a geospatial approach whereby *stocks* of natural capital (assets) at a range of scales (e.g. country or catchment scale) are measured. Knowledge of the extent and condition of natural capital assets allows for integration of the supply and use of services (*flows*) flowing from nature which are then recorded as *benefits* to humanity, in an accounting framework.

Both aspects of the SEEA are designed to work together to build knowledge and information about natural capital assets which can be used in reporting consistently and repeatedly alongside the SNA, enabling the tracking of changes in *stocks* and *flows* over time.

Previous and ongoing EPA projects (such as ESManage, ESDecide, Pollival and work by SEMRU), and other state and semi-state supported projects (NPWS National MAES pilot project, Bord na Móna SEEA accounts, Coillte Corporate Natural Capital Accounts) provide a basis for INCASE as to how to develop natural capital accounts in the Irish context. These projects have identified the range of assets (*stocks*) and services (*flows*) as well as some of the benefits and beneficiaries of Ireland's natural capital. Applying the UN SEEA method, INCASE will build on previous work as well as immediate synergies with projects such as the OSI/EPA Landcover and Environmental Sensitivity Mapping (ESM) Tool projects, the CSO's work on environmental accounting, as well as European Innovation Projects (EIP projects) supported through the Department of Agriculture, Food and the Marine (DAFM).

Once the process to build the accounts is established, some of the potential applications of NCA will be explored, with a particular focus by INCASE on Integrated Catchment Management and water quality. Trade-offs between policy and land use (farming, forestry, infrastructure, energy, planning, etc.) at the catchment scale will be considered, reflecting the current discussions at national level about land use and climate action and the need for evidence-based decision support tools for policymakers.

Feasibility of the INCASE project – building catchment and national contexts

The work to date by the INCASE Project Team has established that developing natural capital accounts at catchment and national scale is feasible. Critical steps include a review and assessment of the wide array and quality of data available in terms of outlining the basic requirements for NCA in Ireland and potential data gaps. Establishing the process steps to gather, collate, assess and align these data in a standardised way is a key output of INCASE. Determining how available data can be used for various accounts follows from the data review.

The project will establish the necessary 'learning by doing' platform and framework from which NCA can be implemented at catchment scale and inform the basis for national scale NCA, either during or beyond the lifetime of the INCASE project as set out in national and EU targets. A number of challenges will be addressed, in terms of high-level concepts about NCA, valuation, the efficacy of the approach in general and basic aspects such as data share and data quality.

Given the experience of the Project Team in NCA and the SEEA approach in particular, and the insights from work by the Steering Committee, it is recommended that the INCASE Project proceeds as outlined in the original project proposal while continuing to build on the work of INCASE to date.

Abbreviations / acronyms

CBD	Convention on Biological Diversity
CNCA	Corporate Natural Capital Accounting
CAP	Common Agricultural Policy
CFP	Common Fisheries Policy
CORINE	Co-ordination of Information on the Environment (EU)
CSO	Central Statistics Office (Ireland)
EAP	Environment Action Programme (EU)
EC	European Commission
EIP	European Innovation Partnership
Eurostat	European Statistics Office (EU)
GDP	Gross Domestic Product
IDEEA Group	Institute for the Development of Environmental Economic Accounting Group
IFNC	Irish Forum on Natural Capital
INCASE	Irish Natural Capital accounting for Sustainable Environments
IPBES	Intergovernmental Panel on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
KIP-INCA	Knowledge Innovation Project Integrated Natural Capital Accounting
LCA	Life Cycle Analysis
LULUCF	Land Use and Land Use Change
MAES	Mapping and Assessment of Ecosystem Services (EU)
MAIA	Mapping and Assessment for Integrated Ecosystem Accounting
NCA	Natural Capital Accounting
NPWS	National Parks and Wildlife Service (Ireland)
NWRM	Natural Water Retention Measures
OECD	Organisation for Economic Co-operation and Development
SDGs	Sustainable Development Goals
SEEA	System of Environmental-Economic Accounting
SEEA-CF	SEEA-Central Framework
SEEA-EEA	SEEA-Experimental Ecosystem Accounting
SNA	System of National Accounts
TEEB	The Economics of Ecosystems and Biodiversity
UK-NCC	Natural Capital Committee (UK)
UK-ONS	Office of National Statistics (UK)

Glossary of terms (working definitions[5])

Atmospheric system and services: The physical and chemical system in the atmosphere consisting of wind, sunshine and precipitation and the outputs (*services*) from atmospheric systems that contribute to human wellbeing. Examples include wind energy, solar energy, rainfall.

Catchment Services: the benefits received by ecosystems and humans from resources and processes that are supplied by catchments. Catchment services are delivered within catchments but are not necessarily bound by the geographical area of a catchment. Catchment services comprise atmospheric, ecosystem, geosystem and human system services.

Ecosystem: all the organisms living in a community and the abiotic (non-living) factors with which they interact.

Ecosystem accounting: refers to the UN SEEA- Experimental Ecosystem Accounting (or SEEA-EEA).

Ecosystem services (provisioning, regulating, supporting, cultural): the outputs from ecosystems which have a benefit and value to human wellbeing.

Environmental accounting refers to national accounting: physical and monetary accounts of environmental assets and the costs of their depletion and degradation; and corporate accounting: either by means of environmental auditing or by costing of environmental impacts caused by the corporation. *Environmental accounting* comprises the activity around the generation of the SEEA-CF accounts.

Geosystem: The underground environment that consists of subsoil, bedrock, minerals, oil, natural gas and groundwater. It does not include soil and the ecosystem associated with soil, or groundwater that provides the abiotic support to ecosystems such as fens.

Geosystem services: The outputs from geosystems that contribute to human wellbeing specifically resulting from the subsurface. Examples include aggregates, minerals, energy from fossil fuels, pollutant attenuation provided by subsoils, geological heritage sites, landscape geomorphology including associated cultural values, groundwater used for drinking, geothermal energy and carbon storage.

Green Accounting: as defined by the OECD is *Environmental Accounting* (see above) and in a broader sense is accepted as the SEEA approach[6].

Natural Capital: the stock of renewable and non-renewable natural resources, (e.g. plants, animals, air water, soils, minerals) that combine to yield a flow of benefits to people.

Natural Capital Accounting (NCA): A way of organising information about natural capital so that the state and trends in natural assets can be documented and assessed in a systematic way by decision makers. NCA is often used interchangeably with the terms *Environmental* and *Green Accounting* though they have different origins and meanings.

Integrated catchment management (ICM): Integrated catchment management (ICM) is based on the concepts of (i) catchments as biophysical units in which natural resources use, and ecological and water protection takes place, (ii) integration of local community and scientific involvement, and (iii) appropriate organisational structures and policy objectives.

SEEA: The System of Environmental-Economic Accounting developed by the United Nations.

SEEA-Central Framework (CF): covers physical accounts (stocks) and flows of environmental assets with the perspective for measurement purposes on individual environmental assets, as well as transactions (such as taxes and subsidies) around the environment.

SEEA-Experimental Ecosystem Accounting (EEA): a geospatial approach whereby stocks of natural capital (assets) at a range of scales (e.g. country or catchment scale) are measured. Knowledge of the extent and condition of natural capital assets allows for integration of the supply and use of services (flows) flowing from nature which are then recorded as benefits to humanity, in an accounting framework.

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[5] Note: a glossary of terms will be developed for the INCASE project; in the meantime, definitions presented here are from EPA, EU MAES, IFNC and Natural Capital Coalition publications in the main.

[6] There is also a body of work around *Green Accounting* in relation to capital and welfare theories https://link.springer.com/article/10.1007/s10640-008-9223-y The nuances and terms will be explored in WP3 of INCASE.

Aims and structure of this report

INCASE (Irish Natural Capital Accounting for Sustainable Environments) is an EPA funded project that explores the application of natural capital accounting (NCA) at the catchment level in Ireland. Working to integrate national and sectoral plans, policy objectives and targets is at the core of NCA approaches and one of the main drivers for the INCASE research project.

This report is written based on the work of the INCASE Project Team completed to date (March 2019-February 2020), specifically in relation to reviewing natural capital accounting (or *Green Accounting*) approaches, the data available to construct natural capital accounts in Ireland and engagement with stakeholders (from local and national, to international levels). **Note, the report *does not* outline the process steps for implementation and development of NCA in Ireland** as that is one of the outcomes of INCASE., i.e. mapping out the process steps, specifically in relation to available Irish data review and assessment, building accounts (extent, condition, services, benefits), identification of data gaps, linking geospatial accounts with the economy, etc.

This report is structured as follows:
- *Chapter 1* introduces the **high level aims and objectives** of the INCASE project, the Project Team and Steering Committee and outlines synergies with other agencies and related projects. We also outline **key concepts around natural capital** and how NCA relates to national and financial accounts to assist in development of better measures of sustainable development. An **overview of the System of Environmental Economic Accounting** (SEEA) (Central Framework (CF) and Experimental Ecosystem Accounting (EEA)) is presented.
- *Chapter 2* sets out the main **policy drivers** and support for NCA internationally, at EU level and nationally.
- *Chapter 3* sets out basic **data requirements** for NCA; outlines the main motivation and support for the project in terms of **synergies with other projects and data sources**; as well as the **potential applications of NCA** to inform integrated decision making across and within sectors (agriculture, climate, forestry marine, etc.).
- *Chapter 4* outlines the focus of the INCASE project in terms of **Integrated Catchment Management.**
- *Chapter 5* summarises the **main conclusions and recommendations** for the EPA review board based on findings of the INCASE project to date.

This report is a summary of the salient features to be considered as part of the EPA review and is supported by two further documents which should be referred to as **essential supporting information** where the reader requires more detail and background:
- **Appendix I:** A Technical Document detailing relevant supporting technical information for this report: information on catchment selection and INCASE catchments; data sources and providers for the relevant SEEA-EEA accounts and SEEA-CF linkages; stakeholder engagement / support and an overview of workshops to date;
- **Appendix II:** The INCASE Literature review (a deliverable of WP1), provides a comprehensive overview of policy, drivers, natural capital approaches at EU and global levels as well as corporate level, and some of the considerations for natural capital accounting for the INCASE project. A **framework for the INCASE project** is outlined in Chapter 6[7].

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[7] https://d8e6820e-0075-4425-94dd-b4a47c78039e.filesusr.com/ugd/94066f_401fbc642f1d420f95e4c7500bdb94cb.pdf

Chapter 1   The INCASE project

Aims and objectives of the INCASE project

> **KEY MESSAGE:** *The INCASE project will provide a platform whereby the process of natural capital accounting (NCA), the outputs and steps in the process and potential applications can be developed in the Irish context. INCASE will inform on the extent and condition of natural capital, the associated services and benefits, where investment and/or restoration will be required and where it should be prioritised at the catchment level to deliver on RBMPs, with a view to how the work is scaled up to national level.*

Applying the UN System of Environmental-Economic Accounting (SEEA) approach – the most widely used NCA approach at the EU level and globally - INCASE will pilot the development of a suite of relevant natural capital accounts at catchment scale to provide a comprehensive view of the stocks of natural capital assets and the flows of services within each catchment. How these stocks and flows relate to society will also be investigated. Working at the catchment level, INCASE will inform through a process of *learning by doing* **how best to develop catchment natural capital accounts, with a view to informing how to scale up to national level.** Four catchments have been selected for INCASE, representing a range of conditions and characteristics (*see* pages 6-10 of Appendix I).

While NCA has a range of potential uses and applications, the central focus of INCASE is to inform how NCA (specifically the SEEA approach), can assist with reporting and/or working towards water protection and management in the context of implementation of the Water Framework Directive River Basin Management Plan (RBMP) for Ireland in the period 2022-2027. INCASE will link the NCA approach with the Integrated Catchment Management (ICM) approach already in use in RBMPs.

It should be noted, that while ICM was originally developed as the approach in Ireland for water management, the increasing awareness of the connectedness of our natural environment (water, habitats, soils, GHG emissions) and of the co-benefits of considering all natural systems (eco-, geo-, atmospheric systems) together as a broader interconnected system, highlights that catchments are landscape units where these systems align. Linking NCA with ICM, thereby broadens the perspective of ICM as used and promoted by the Catchments Unit of the EPA, bringing focus to the dependencies between land use planning and environmental management in general.

INCASE runs from March 2019 to March 2023 with the following main objectives and associated work packages:

- WP1: Review NCA approaches, identify data sources and develop a framework to test NCA application in Ireland (*completed* February 2020);
- WP2: Apply the SEEA approach at catchment level[8]; develop natural capital accounts (extent, condition, services supply and use, benefits) for each of the four selected catchment areas;
- WP3a: Based on the application of the NCA approach in WP2, develop tools for decision-makers, including visualisation, quality assessment, and framework development;
- WP3b: Conduct economic impact assessments linking the outputs of WP1 and WP2 with the economy;
- WP4: Stakeholder engagement will form a significant part of the project at all stages.

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[8] Four pilot catchment areas were selected in November 2019; *See* Table A3 Appendix I.

INCASE project team, steering committee and supporting network

> **KEY MESSAGE:** *The INCASE Project Team and Steering Committee has the technical expertise and experience to deliver the different aspects of the project. Stakeholder support for the project will strengthen the outputs, maintain a relevant focus as well as inform applications and uses across and between sectors.*

Taking a multidisciplinary approach reflects that taken in other NCA initiatives in the EU Region, in individual EU Member States and globally. The INCASE Project Team brings together different disciplines, organisations and expertise in an integrative way, with work by researchers in:

- Trinity College Dublin: Professor Jane Stout and Dr. Catherine Farrell (Terrestrial and Restoration Ecology)
- University College Dublin: Assoc. Professor Mary Kelly-Quinn and Dr. Siobhan Atkinson (Freshwater Ecology)
- University of Limerick: Dr. Stephen Kinsella (Macro-economy)
- National University of Ireland, Galway: Dr. Cathal O'Donoghue (Micro- and Bioeconomy)
- IDEEA (Institute for the Development of Environmental Economic Accounting) Group[9]: Mark Eigenraam (Director, IDEEA Group) and Carl Obst, (Director IDEEA Group and lead author UN SEEA-EEA)
- IFNC (Executive Co-ordinator of the Irish Forum on Natural Capital): Orlaith Delargy.

In addition to the Project Team, the Steering Committee for the INCASE Project includes multi-disciplinary expertise and has provided valuable support and insight to the INCASE Project to date:

- EPA Catchments Unit: Paddy Morris
- Former Head of EPA Catchments Unit: Donal Daly
- Central Statistics Office (CSO): Gerry Brady (co-ordinator of the SEEA-CF accounts in Ireland)
- Former Director-General of Eurostat: Dr. Walter Radermacher (presently at University of Sapienza, Rome)
- National Parks and Wildlife Service (NPWS): Gemma Weir (Ecological Data Manager, co-ordinator of Irish National MAES pilot project)
- Dept. Climate Change and Environment: Dr. John O'Neill (Head of Climate Adaptation)
- MDT[10] Fellow in Natural Capital Accounting, Hutton Institute: Dr. Paola Ovando

Both the Project Team and the Steering Committee have already established links with key stakeholders nationally and internationally. The project has also received the support of a number of key organisations (*see* Table A5 and A6, Appendix I), including:

- State agencies / departments: EPA Catchments Unit; CSO; NPWS; NBDC (National Biodiversity Data Centre), GSI (Geological Survey Ireland); Forest Service, Teagasc, Irish Water, DAFM; DCCAE; DHPLG; BIM; BNM; Coillte; Local Authorities;
- Related projects: OSI/EPA Landcover mapping project; EPA Environmental Sensitivity Mapping Tool Project; EIP Projects (Pearl Mussel Project and Bride Regenerative Farming Project); Kerry-Life project; ESDecide, Land2Sea and other related research projects.

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[9] www.ideeagroup.com IDEEA is based in Australia and has carried out seminal work in NCA globally, as well as working with BNM and BIM in Ireland since 2018.
[10] Macaulay Development Trust.

Natural capital accounting – key concepts

> **KEY MESSAGE:** *Natural capital has unique features which relate to the diversity of nature, the complexity of living systems, capacity, condition, non-linearity, feedback loops and resilience. An appropriate asset accounting model is therefore required for the purposes of accounting for natural capital assets and flows; one that can be standardised to allow for comparative and repetitive measurement and reporting at national, regional, catchment, or site/business level.*

Natural capital – the foundation of all capitals

The International Integrated Reporting Council[11] defines the term 'capitals' as referring to any store of value that an organisation can use in the production of goods and services, distinguishing six capitals for reporting purposes (as illustrated below).
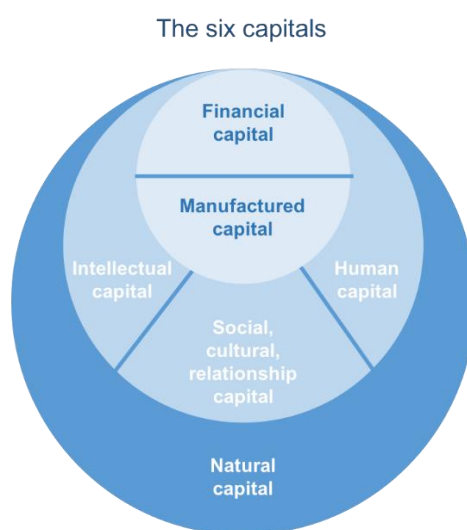

Figure 1. The Six Capitals. *Source*: https://integratedreporting.org/

All types of capital are needed to support human welfare, and human capital combines with natural capital to create manufactured and/or financial capital. However, as Figure 1 illustrates, **all other capitals rely on natural capital.** This reflects discussions around the Sustainable Development Goals (*see* Figure 4) and again, the nested approach clearly defines the role of nature as that which underpins all else.

Natural capital accounting – stocks and flows

From an accounting perspective, defining natural capital as an important and valuable capital or *stock* brings the discussion around nature into a common language more traditionally associated with economics. It also re-enforces the need to replenish and invest in nature's stocks to bring them to a level appropriate to sustain the present human population, and future population scenarios (following from Brundtland 1987[12], and IPBES and IPCC reports in 2019). Within the context of NCA, another key concept is that of *services*. The services that *flow* from nature to humans and our economy provide a wide range of benefits including the provision of food, regulation of the climate, and the landscapes and vistas that provide us with recreational use and ultimately health and wellbeing. These services flow from the stock of natural capital[13].

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[11] https://integratedreporting.org/

[12] https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

[13] The ecosystem is most widely used as the defined unit or asset of natural capital, reflecting the term as defined in the Convention on Biological Diversity (CBD) – a product of the biotic and abiotic components of nature, though the same approach can be taken with geosystems and atmospheric systems.

KEY MESSAGE: *The INCASE Project Team (ecologists, economists and practitioners) and the combined guidance of the Project Steering Committee (policy makers, catchment scientists, data managers, statisticians and environmental economists), will serve as a discussion platform for the potential role of NCA (specifically the SEEA) to link with the SNA in Ireland; thereby working towards developing better metrics of sustainable development.*

Accounting for nature – *or taking nature into account* - is recognised as a key feature of working towards and tracking sustainable development[14]. Because the traditional economic way of measuring stocks and flows has been well tested and widely used to date, a similar approach is now being taken with natural capital. The main system in development, upon which NCA approaches have formed or have emerged from, is the UN System of Environmental and Economic Accounting, also known as the SEEA[15].

A key aspect of the SEEA is that it builds on GDP, by means of *extending the boundary* of the SNA. By extending the SNA framework and the traditional economy boundary, this helps to mainstream environmental information within regular discussions on economic and development policy. It also enables linkage of NCA with the System of National Accounts (SNA) (or at an individual corporation scale, a company's financial accounts). Essentially, the main high-level motivation is the development of **more reflective aggregates for prosperity** and wellbeing than is currently achieved by the widely cited GDP (Gross Domestic Product).

From an economic perspective, the role of the SNA and specifically the metric GDP, it is recognised **that GDP is limited**. A full balance sheet approach to economic sustainability would also imply a more nuanced approach to sustainability, one that is not likely to rely on a single number or metric. Similarly, for human capital, a broader perspective than that currently taken requires addressing difficult measurement questions such as how to measure non-cognitive skills and non-market benefits, both individual and social, and understanding and measuring specific human capital and networks (consider the development of alternative welfare indices outlined in Chapter 2, INCASE Literature review (Appendix II)).

Natural capital, green and environmental accounts – what terminology?
NCA approaches are often referred to as green accounting, environmental accounting and/or ecosystem accounting, though there are very clear differences in the terms and origins of use. *Green Accounting* is defined by the OECD essentially as Environmental Accounting[16]. This definition by the OECD relates *Green Accounting* directly to the UN SEEA, although there is a broad body of work relating to green accounting in capital and welfare theories. In the wider lexicon, natural capital accounting is frequently used and provides a broadening of the context to all natural systems.

Developing **a terminology for INCASE** - one that works **in the Irish context** though aligned with EU and international approaches – will be an output of the project.

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[14] Alongside better measures of societal and human wellbeing.
[15] https://seea.un.org/
[16] https://stats.oecd.org/glossary/detail.asp?ID=1146

> **KEY MESSAGE:** *The SEEA approach, and specifically the SEEA-EEA component, represents initial efforts to define a measurement framework for tracking changes in ecosystems and their outputs, and by extension other natural systems; linking those changes to economic and other human activity by means of the combination of the SEEA-CF and SEEA-EEA accounts.*

There are two components of the SEEA: the SEEA-Central Framework and the SEEA-Experimental Ecosystem Accounting.

- *The SEEA-CF* covers **physical accounts and flows** of environmental assets and expenditure with the perspective for measurement purposes on individual environmental assets, such as timber resources, land, mineral and energy resources, and water resources[17].
- *The SEEA-EEA* is **a geospatial approach** whereby *stocks* of natural capital (assets) at a range of scales (e.g. country or catchment scale) are measured. Knowledge of the extent and condition of natural capital assets allows for integration of the supply and use of services (*flows*) flowing from nature which are then recorded as *benefits* to humanity, in an accounting framework.

The SEEA-EEA constitutes an integrated statistical framework for organising biophysical data, complementary to that of the SEEA-CF, although it does not yet have the status of an international statistical standard[18]. Both aspects work together, enabling the tracking of changes in *stocks* and *flows* over time. The SEEA-EEA will be the main focus for INCASE WP2, linking SEEA-CF data collated by the CSO to develop benefits accounts (WP2) and economic linkages in WP3.

There are four key stages in the SEEA-EEA to fully outline geospatial extent, condition and relationships of natural capital assets (stocks), as well as accounting for flows of services and benefits:

- *Asset extent* – type, range and scale of natural capital assets. The output of this stage is a geo-referenced map, the scale depending on the spatial unit (county, catchment or farm) and an asset register or account (in the form of a table / balance sheet).
- *Asset condition* – quality of the asset. For example, a peatland may be drained, which would be lower condition than one with no drains, which impacts on its capacity to sequester carbon but also its biodiversity. Condition of assets influences the ability of an asset to deliver one or more services and as condition will vary over space and over time, condition mapping is a key spatial component. At this stage, maps showing asset condition and pressures, and a *Risk register* - highlighting areas of degradation - can be developed.
- *Services* – identification of the services, whether within the system or as a product of the system. In the case of a peatland this may be carbon sequestration (a service) or emission (a disservice), and/or water attenuation. Similarly, services may rely on a combination of and the interaction of multiple assets. Mapping services will be a product of the pressures and condition mapping in previous steps, as well as using other relevant geo-spatial data.
- *Benefits* – the benefits to humans and who the beneficiaries are. For example, the benefit may be climate regulation and/or flood control, and the beneficiaries either local or downstream (flood mitigation) or global (reduced carbon emissions to atmosphere). For many services there is a spatial correlation between potential beneficiaries and service availability.

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[17] A number of environmental accounts are collated by the Central Statistics Office in Ireland and reported to Eurostat (listed in Appendix I) https://www.cso.ie/en/statistics/environmentaccounts/

[18] The SEEA-EEA was separated out from the SEEA-CF aspects to allow for its refinement and development while the SEEA-CF could be implemented immediately.

Figure 2. The Core NCA Framework. *Source*: IDEEA Group.

Using NCA to inform trade-offs, co-benefits and disservices

KEY MESSAGE: *Integrating NCA as a tool in decision making facilitates multiple analyses, including identification of trade-offs, disservices and co-benefits. The accounts present a standardised filter and a common platform on which to inform integrated and inter-sectoral decision making. INCASE will explore how this can work at the catchment level in Ireland.*

The information organised within the context of NCA can provide an indication of impacts (both positive and negative) of economic and other human activity on the environment and therefore highlight the **potential trade-offs** among the different combinations of services that are generated from alternative uses of assets. With its potential to inform on environmental impacts and trade-offs in natural capital use, NCA provides a framework for responding to the growing demands for information in policy areas such as sustainable development, resource use and land management. **The SEEA Framework can work as a filter** (Figure 3) through which decision makers can weigh up the outcome / benefits (co-benefits and dis-benefits) of policies (*see* Chapter 3).
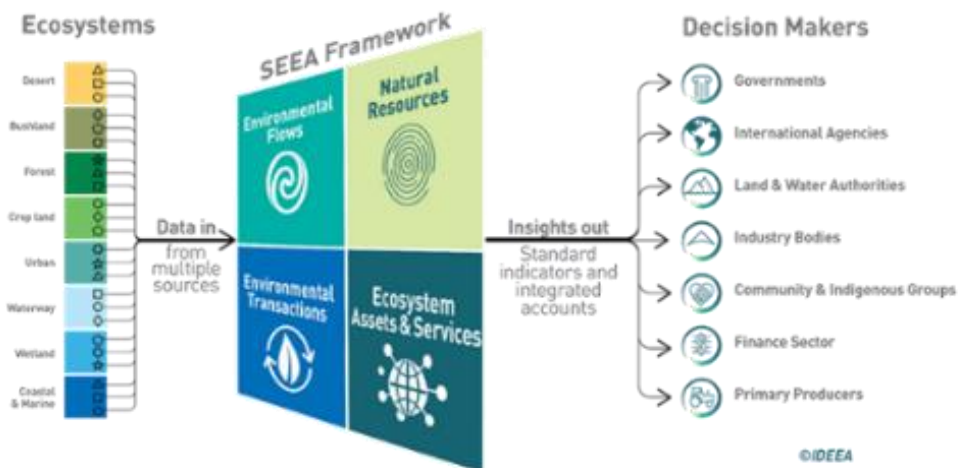

Figure 3. The SEEA Framework provides a filter for standardised information. *Source*: IDEEA Group.

Questions for INCASE – treating systems the systems way

KEY MESSAGE: *NCA systems must take account of the complexities and non-linearities of natural systems. An iterative approach will be taken by INCASE to inform discussions nationally and at EU level, around applications, valuation and effectiveness of NCA at different scales.*

Systems thinking: In terms of natural capital, moving **beyond the measurement of individual stocks** of natural capital and taking the systems approach to nature (ecosystem, geosystem, atmospheric system) considers the 'interplay of different assets (for example, within a forest, there is an interplay between water, timber, soil, and wildlife)', making clear that, in order to measure environmental

sustainability, more than the measurement of stock (the classic approach to capital accounting) is required. Ecosystems, and inter alia natural systems in general, are not a collection of different stocks but, more fundamentally, systems.

How then to account for nature? Splitting nature into defined units / accounts (despite the assertion that essentially *nature flows*), **recognising non-linearities, accounting for resilience, understanding how systems work together** – these are features of nature that did not feature for discussion in development of the traditional accounting approach to other 'capitals'. Therefore, any NCA system must take cognisance of these paramount features, developing as an approach that deals with realities and does not attempt to merely squeeze natural systems into 'neat boxes'. This is a challenge for all NCA projects and re-enforces the contribution of the INCASE project to broaching this and other pertinent challenges / assumptions around valuations (*can we put a price on nature?*) and sustainability indicators (*is 42 really a valid answer?*).

A filter for better decisions? NCA is one tool that may be used in decision-making, noting that decision making occurs at different spatial scales. **NCA may prove a valuable system at a local, catchment level, while national level may present different issues**. Aggregated accounts give a broad picture, with no details on the complexity involving the interactions of geology, water, vegetation, biodiversity, climate, and external and anthropogenic drivers (climate change, land use changes, regulations). Furthermore, spatial data aggregation may introduce bias[19]. Therein applications of NCA will have to be evaluated on their own merit and at different scales. As a consequence, NCA must retain an iterative approach, to ensure it can be honed as a useful, fit-for-purpose tool that can continue to evolve as data quality, understanding and learnings evolve.

Keeping it real: For multi-disciplinary approaches to bear fruit, they require a high level of self-awareness of potential inherent bias on the part of the individual components of the 'multi'. A **critical analysis of ideas and issues** over the course of the INCASE project is vital to develop a robust and defensible system, with practitioners that are aware of their own biases and possible shortcomings in the NCA system itself that is being tested by INCASE (as in other projects testing the SEEA approach and the issues being addressed in the ongoing SEEA-EEA revision process[20]).

NCA for businesses and organisations

> *KEY MESSAGE***:** Corporate Natural Capital Accounting is becoming widespread as companies are required to identify and link dependencies and impacts on nature (through natural capital assessments or accounts) to financial accounts.

Corporate Natural Capital Accounting (CNCA) applies similar principles to that of the UN SEEA in that the accounts are structured and standardised **to align with financial accounting[21]** at a business / organisation / site level, allowing for the accounts to be updated repeatedly and consistently. Employing a common language (as in CNCA) enables ease of communication and understanding between natural capital accounts and national income / financial accounts. Other frameworks such as the Natural Capital Protocol[22] are widely adopted by business and organisations to **identify and link dependencies and impacts on nature** (through natural capital assessments or accounts) to financial accounts.

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[19] http://doc.teebweb.org/wp-content/uploads/2017/01/ANCA-Tech-Guid-8.pdf
[20] https://seea.un.org/content/seea-experimental-ecosystem-accounting-revision
[21] CNCA is an accounting tool developed to fit with the structure of a company/organisation's financial accounts as opposed to following the UN SEEA structure.
[22] Pioneered by the Natural Capital Coalition, recently named the Capitals Coalition https://naturalcapitalcoalition.org/

Chapter 2   NCA policy drivers

International policy – CBD to SDGs

> **KEY MESSAGE:** *Policy at international level reflects the main drivers for NCA, which are to arrest the further deterioration of the natural environment and ensure sustainable development for humans globally. **By not taking nature into account in decision making**, widespread ecological degradation has occurred leading to local and global critical levels of biodiversity loss and global climate change with ongoing and repeated calls for transformative changes in human behaviour to prevent further degradation beyond critical thresholds (IPBES 2019, IPCC 2019).*

NCA emerged from the 1960s and 70s, when an increasing awareness of human impacts on nature and natural resources culminated in the 1987 Brundtland Commission Report *Our Common Future.* The first efforts to develop 'environmental' accounts that would bring nature into the accounting framework, and which aligned with the long-established System of National Accounts (SNA), arose after the Earth Summit in Rio de Janeiro in 1992, and have been in development since.

In 1993, the first draft of the UN System of Environmental-Economic Accounting or SEEA was published. Following from this, the Millennium Ecosystem Assessment (2000 to 2005) and The Economics of Ecosystems and Biodiversity (TEEB, established in 2008) initiatives highlighted the importance of recognising the value of natural capital, ecosystem services and the benefits that we receive from nature. Prior to this, **nature – or natural capital - had never featured as something to be accounted for on balance sheets.**

The present CBD Strategic Plan for the period 2011-2020 has a set of strategic goals and targets (the Aichi Targets). Of these, Target 2 of Strategic Goal A is of note for Natural Capital Accounting, which states that: ***by 2020**, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems*[23]*.* Target 2 is reflected in the EU Biodiversity Strategy 2011-2020[24], and the Irish National Biodiversity Action Plan 2017-2021[25] (DAHG, 2017).

The Aichi goals underpin Agenda 2030 for Sustainable Development and the Sustainable Development Goals (SDGs, Figure 4), highlighting that nature is critical to human wellbeing and that the health of people and nature are inextricably linked. The Aichi Goals and SDGs both stress inter-disciplinary issues such as raising awareness about biodiversity, removing harmful subsidies that cause biodiversity loss, applying the ecosystem approach to understanding and conserving nature, and cross-sectoral planning to ensure sustainable development and use across agriculture, forestry, fishing, industry, infrastructure and other commercial enterprise[26]. These messages are re-enforced by the 2019 IPBES report[27] which demonstrated widescale biodiversity losses globally, and the IPCC report[28] which indicates links between land degradation and climate change. Both reports highlight **the need for radical, transformative changes in human behaviours and systems** if we are to achieve the Aichi Targets and SDGs. A new set of targets is under development for post-2020[29].

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[23] www.cbd.int/doc/strategicplan/2011-2020/Aichi-Targets-EN.pdf
[24] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52011DC0244&from=EN
[25] https://www.npws.ie/legislation/national-biodiversity-plan
[26] www.cbd.int/doc/strategicplan/2011-2020/Aichi-Targets-EN.pdf
[27] https://ipbes.net/global-assessment
[28] https://www.ipcc.ch/srccl/
[29] https://www.cbd.int/conferences/post2020

> **KEY MESSAGE:** *Policy at EU and Irish levels enforces the international thinking around natural capital accounting. At both levels, the target date **of 2020** is set whereby natural capital accounts are to be developed and integrated into national planning and sectoral policy / decision making. In particular, the **EU Green Deal** sets out the fundamental focus for all activity in the EU for the next decade.*

EU Biodiversity Strategy

In May 2011, the European Commission adopted the EU Biodiversity Strategy , entitled *Our life insurance, our natural capital: an EU biodiversity strategy to 2020*. The strategy is in line with the global commitments, in the context of the Convention on Biological Diversity (*see* Chapter 2, Appendix II for more detailed discussion on policy). Action 5 of Target 2 has the most resonance in terms of Natural Capital Accounting: *Map and assess the state and economic value of ecosystems and their services in the entire EU territory; promote the recognition of their economic worth into accounting and reporting systems across Europe.*

Specifically, this action relates to the MAES (Mapping and Assessment of Ecosystem Services) and the EU-KIP INCA (Integrated Natural Capital Accounting) projects which have been ongoing in EU since 2011. Note that a **new EU Biodiversity Strategy is due in March 2020**, and this will more than likely set stronger targets around natural capital accounting following from the communication around the **EU Green Deal** (*see next*).

7th Environment Action Programme

The 7th Environment Action Programme (EAP) (EC, 2014) builds on the significant achievements of 40 years of EU environment policy and draws on several strategic initiatives in the field of environment with particular reference to the protection, conservation and enhancement of the EU's natural capital (Article 2). The 7th EAP outlines that: **by 2020:** *the value of natural capital and ecosystem services, as well as the costs of their degradation are properly assessed and considered in policy-making and investments*. This requires actions in relation to sustainable development, NCA and public and private reporting on these topics, such as[30]:

- Developing and applying **alternative indicators that complement and go beyond GDP** to monitor the sustainability of progress and continuing work to integrate economic indicators with environmental and social indicators, including **by means of natural capital accounting;**
- Further developing and encouraging '**payments for ecosystem services'** schemes;
- Putting in place incentives and methodologies that stimulate companies to measure the **environmental costs of their business and profits** derived from using environmental services and to disclose environmental information as part of their annual reporting. Encouraging companies to exercise due diligence, including throughout their supply chain.

European Green Deal 2019

The new European Green Deal published at the end of 2019[31] specifically aims to protect, conserve and enhance Europe's natural capital, and protect health and wellbeing from environment-related risks and impacts, and states that: *all EU policies should contribute to preserving and restoring Europe's natural capital*. In addition, the development of **standardised natural capital accounting** practices is explicitly mentioned as part of the range of initiatives to pursue green finance and investment. The **EU Green Deal essentially sets the tone** for the next EU Biodiversity Strategy and EAP, clearly **underlining the role of NCA in the next decade and beyond**.

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[30] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013D1386
[31] https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

Ireland's National Biodiversity Action Plan 2017-2021

The National Biodiversity Action Plan 2017-2021 plan largely reflects the targets set out in the EU Biodiversity Strategy and Action Plan 2011-2020 with the work around NCA[32] supported by two actions:

- Action: 1.1.10. *Develop a Natural Capital Asset Register and national natural capital accounts **by 2020** and integrate these accounts into economic policy and decision-making*.
- Action: 1.1.11[33]. *Initiate natural capital accounting through sectoral and small-scale pilot studies, including the integration of environmental and economic statistics using the framework of the UN System of Experimental-Ecosystem Accounting (SEEA).*

The EPA view on sustainable development and natural capital accounting.

The EPA State of the Environment Report 2016[34] presents an overview of the present status and trends in Ireland's environmental quality and health. While Ireland's environmental quality status is overall relatively good compared to other EU Member States, the authors recognise that maintaining that standard during a period of growth in the Irish economy will be challenging. The report highlights that economic growth is clearly dependent on the environment, and in order to deliver steady and sustainable economic activity, the environment requires greater understanding and attention.

The report specifically highlights the need to **integrate NCA into our measures of prosperity** in a way to help in tracking and measuring our performance alongside related issues such as wellbeing and environmental health.
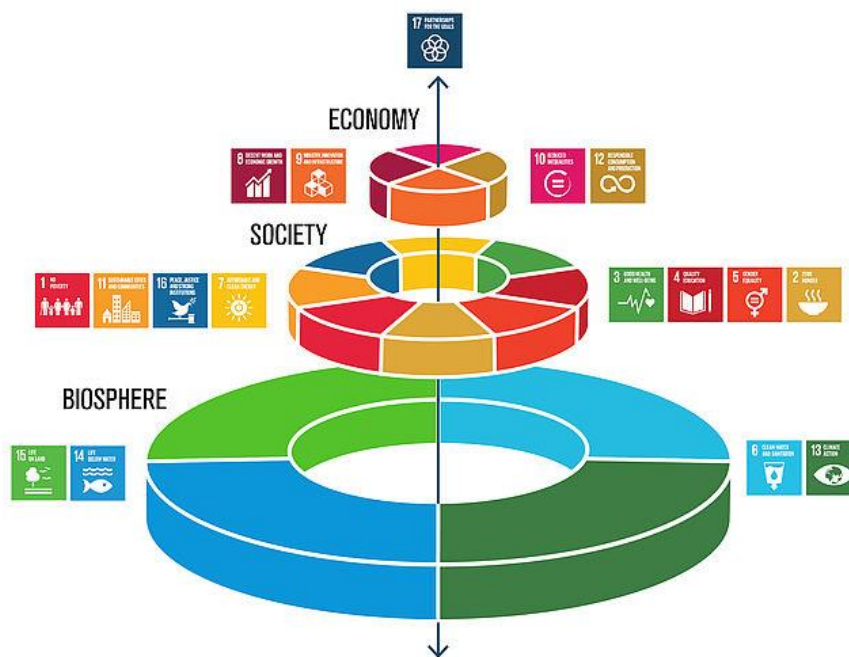

Figure 4. The Sustainable Development Goals wedding cake: the biosphere (nature) underpins economy and society. *Source*: https://profesus.eu/sustainable-development/sdgs/

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[32] Although a national pilot project was undertaken by the NPWS in 2016 to develop a national spatial framework for ecosystem services mapping and assessment using available national data, it has not been developed since (Appendix I).
[33] The performance Indicators are a number of pilot studies initiated, and a number of national accounts completed.
[34] Protecting, conserving and enhancing our natural capital is also explicitly referred to in the National Planning Framework (2018).

Chapter 3 INCASE – making NCA the norm

NCA in Ireland – working locally, within a global network

> **KEY MESSAGE:** *NCA has been widely adopted globally, specifically the SEEA method. The INCASE Project builds on the work carried out on aspects of NCA and related topics to date in Ireland, bringing it together under the NCA framework. This will help to develop the best way forward for NCA in Ireland, and therefore avoid ad hoc staggered steps which would otherwise be unproductive.*

Presently more than 80 countries worldwide have adopted the SEEA approach[35], with the SEEA-CF in mainstream use and SEEA-EEA gathering wider use as the method is refined and becomes normalised.

In the EU, NCA has been well developed in the UK and the Netherlands in the period 2010-2020, with work progressing under the EU KIP-INCA[36], MAES [37] and MAIA[38] (Mapping and Assessment for Integrated ecosystem Accounting) projects. Discussions at Eurostat are ongoing as to how NCA will be implemented across the European Union, and this is largely being informed by these projects. The SEEA-CF has already been integrated into National Statistics Offices' reporting across the EU while the SEEA-EEA will become mandatory as the method is refined at UN and EU level (next revision of the SEEA-EEA due in 2020[39]).

While work is ongoing globally in relation to NCA, Ireland has taken preliminary steps, though **a clear strategy on how to apply NCA either at local or national scale is lacking**, despite the policy drivers and frequent use of the term *Natural Capital* in Governmental publications (*National Planning Framework; Green Economy Initiative*), policy documents and reports (SDG Voluntary Reporting[40]) as well as EPA publications.

A national forum on the topic of natural capital – the Irish Forum on Natural Capital - was established in 2014[41]. This has representation from state, semi-state and private organisations, serving as a discussion and learning platform around aspects of NCA. Research projects in Ireland are also informing aspects natural capital stocks and flows, with a view to developing more integrated policy and management approaches. These are largely funded by the EPA (Chapter 5, Table 5.1 of INCASE Literature review, Appendix II).

Work is also being carried out in the business community with both Coillte and Bord na Móna developing natural capital accounts for their land holdings. Bord Iascaigh Mhara[42], Dublin Port Authority and others also at the scoping stages. Coillte has applied CNCA, while BNM[43] (2018-2020) and BIM (2019-2020) both applied the SEEA method, working with the IDEEA Group on these projects.

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[35] https://seea.un.org/content/global-assessment-environmental-economic-accounting
[36] https://ec.europa.eu/environment/nature/capital_accounting/index_en.htm
[37] https://biodiversity.europa.eu/maes
[38] http://maiaportal.eu/home/
[39] https://seea.un.org/content/seea-experimental-ecosystem-accounting-revision
[40] https://www.dccae.gov.ie/en-ie/environment/topics/sustainable-development/sustainable-development-goals/Pages/Voluntary-National-Review-2018.aspx
[41] https://www.naturalcapitalireland.com/ Both Prof. Stout and Dr. Farrell are founding members of the IFNC.
[42] http://www.bim.ie/our-work/projects/exploring-natural-capital-solution-seminar/
[43] https://www.youtube.com/watch?v=F-CuHksINaY

INCASE - building a centralised data platform

> **Key Message:** *In Ireland there is a wealth of environmental data, as well as data on land cover and land use held by a range of agencies. INCASE will establish the process steps of NCA to bring data on natural capital stocks and flows of services into a centralised data platform which can be used in a multi-disciplinary way to inform policy decisions at sectoral and inter-sectoral levels.*

In order to apply the SEEA approach at catchment level, the following steps and supporting information / data sets are required at a minimum:

- *Asset extent*: land cover data and or habitat mapping at the national level;
- *Asset condition*: pressures and condition indicators based on Irish context;
- *Services*: information on the range of services (provisioning, regulating, supporting, cultural);
- *Benefits* (users): an understanding of activities and benefits created by assets within each catchment and who are beneficiaries;
- SEEA-CF accounts: the Project Team will work with the CSO to link the outputs of the SEEA-EEA with data gathered by the CSO to develop environmental accounts at the catchment level (where possible).

Data requirements for NCA

In terms of data, there is a number of basic criteria for use of datasets (*see* Appendix I) which must be adhered to for NCA. There is **a wide array of datasets and systems in operation** across agencies, state departments and academic institutions in Ireland which will facilitate building the accounts[44] (Appendix I). The basic data requirements for the INCASE project will include data on land cover (OSI/EPA landcover maps), Corine landcover (available through EU), land use (DAFM and Teagasc data), catchments (EPA), soils, aquifers and bedrock (GSI), water use (Irish Water), water quality (EPA), forest cover (Forest Service and Coillte), peatlands (DIPM[45], BNM, Coillte), habitats and species (NPWS and others[46]), CSO environment accounts and planning data (Local and Regional Authorities). A number of other datasets are also available at catchment scale[47] to create a more detailed output at a finer level. As well as the required data, the level of **technical expertise within these organisations is also a major strength** to bring the natural capital accounts together.

Once the data are collected they are brought together using computer modelling tools, such as the EnSym tool[48], to create a **seamless geospatial database**, from which accounting tables are developed. Bringing the data into a centralised platform and establishing the level and quality of data required for each account will be a central aspect of the INCASE project (WP2). Building a data platform / structure fit for INCASE, but also to exist beyond the project - one that is modular and open source to facilitate development over time - will help progress co-ordinated and efficient NCA in Ireland. INCASE will provide insights as to how that may be achieved. It should be noted that one of the recommendations in the SEEA-EEA Technical Guidance[49] notes is the need to **establish a national spatial data infrastructure (NSDI)** that would support integration of environmental and socio-economic data.

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[44] Different data is required for asset extent, condition and services / benefits accounts. Bringing available data together and evaluating quality and relevance, as well as gaps will form a significant part of the INCASE work.

[45] DIPM: Derived Irish Peatland Map.

[46] EPA, Teagasc, Coillte, Forest Service, Local Authorities, NBDC, Heritage Council, etc.

[47] The NPWS collated, reviewed and assessed over 300 spatial datasets for use in their national pilot implementation of EU MAES project in 2016.

[48] https://ensym.biodiversity.vic.gov.au/cms/ developed by the Victoria State Government (Australia) with members of the IDEEA Group.

[49] Section 3.6.1: Developing a NSDI.

Synergies with ongoing projects

The INCASE Project will work to develop synergies with existing projects, not least the EPA / OSI land cover mapping project which will deliver a solid database for developing natural capital accounts. The land cover maps are due for completion across Ireland in 2020.

At national level, the **Environmental Sensitivity Mapping** (ESM) tool developed recently as part of an EPA research project has obvious immediate, potential synergy with the INCASE Project. Combining the outputs of INCASE (mapping data showing extent and condition of natural capital assets, services etc.) with the ESM Tool which aims to inform better planning decisions in Ireland would provide a better information system for planners in Ireland. Particularly, for the purpose of identifying the natural capital asset network of *stocks* and *flows* of services throughout that network. Following from this, planners can work to ensure maintenance and management of those stocks and flows with regard to wider issues such as climate change and biodiversity loss, though this requires further integrated sectoral plans at catchment and national level.

By extension, the same datasets may be used for development of **Payment for Ecosystem Services** schemes and contribute to CAP reform in Ireland. Other synergies can also be developed with the recent work on **EIP projects** at catchment level (for example the Pearl Mussel Project in the Caragh catchment and the BRIDE Regenerative Farming EIP) (*see next*).

Applying NCA in Ireland

> **KEY MESSAGE:** *Stakeholder engagement is a central part of the SEEA approach and will inform the process at catchment level but also potential applications and uses by other agencies at national and catchment level. Overall, the approach is viewed as an important step to integrate policy as well as provide a standardised platform for a range of sectors and applications.*

Integrating data sets and expertise in Ireland in a multi-disciplinary way will create a platform to enable efficient and effective delivery of environmental targets locally and nationally, as well as contributing to better reporting measures on sustainable development. While this is one of the main motivations for NCA, collating data in such a standardised format can enable better informed decision making around land use and potential trade-offs (*see Chapter 1*). Based on stakeholder engagement and discussion to date (*see* Appendix I, Table A5 and A6), as well as the examples from other countries there is a range of potential applications that may develop either at catchment or national level. **Overall, the approach is viewed as an important step to integrate policy as well as provide a standardised platform for a range of sectors and applications.** Some of the applications discussed to date include:

- *Integrated Catchment Management*: this is the main focus of the INCASE project. **Water quality** relies on integrated and informed decisions around land use (forestry, agricultural, mining, industry, infrastructure etc.) and a full set of NC accounts will inform discussions and help enable integrated decisions around activities in a catchment.
- *CSO Environmental accounting*: the CSO already reports to Eurostat on a number of SEEA-CF accounts (*see* Appendix I); building the SEEA-EEA aspect will align information on natural systems with the accounts already reported to Eurostat and those in the future.
- *Planning urban and rural development*: population growth is one of the main challenges in Ireland. Developing serviced **urban settlement while mitigating rural decline** and balancing climate action targets on planting etc. will benefit from NCA. Irish initiatives such as the Environmental Sensitivity Mapping tool could be linked with NCA to enable better information for planning in the form of a robust baseline for future plans.

- *Marine*: following from the WFD and ICM, **quality of the marine environment** is strongly linked with activities on land (and MSFD and CFP). BIM is exploring how to apply NCA to the seafood industry and the outputs will feed directly into the INCASE catchments that have immediate contact with fisheries. Work is also ongoing in the Marine Institute in relation to ecosystem assessment.
- *CAP Reform:* Developing **Payment for Ecosystem Services** schemes for landowners can be facilitated by using the information provided by NCA, targeting work to either maintain and/or restore natural capital stocks and flows. This would build on a number of ongoing EIP projects co-ordinated by DAFM and some of the reforms proposed under the EU CAP.
- *Forestry*: the Irish Government has set ambitious targets around planting trees as part of its Climate Action Plan. Managing planting / natural regeneration to ensure trees are planned for the right soils, **linking native woodland networks and long-term carbon stores** / sinks will be critical for those targets to be realised.
- *Peatland management:* peatlands cover up to 20% Irish landscape and deliver range of services at catchment level (water filtration, regulation of water flows, biodiversity) and globally (carbon). Co-ordinating and tracking **peatland rewetting** using NCA will have multiple benefits for climate, water, people, and biodiversity (as in the Figile catchment – *see* Appendix I).
- *Biodiversity*: mapping the extent and condition of natural assets and linking these, and their constituent parts, to the multiple services they provide to humans, will enable the interactions between biodiversity and humans to be better understood and enable outcomes from planning decisions to be modelled for **coherent planning for sustainable biodiversity networks**. Planning for nature will enable linking wildlife corridors with Green and Blue infrastructure initiatives within LA and regional planning objectives[50].
- *European networks:* There are obvious synergies between INCASE and the EU INCA, EU MAES and EU MAIA projects. Working as part of a European network will enable the development of NCA in Ireland to benefit from lessons learned across Europe, as well as work to reform EU Directives and policy instruments relating to land use.
- Other potential applications: LULUCF reporting (as in the Netherlands), SDG reporting, developing carbon tax schemes and creating public awareness. Development of novel market mechanisms that allow win/win solutions at maximum efficiency for environmental outcomes and local communities will also be explored e.g. reverse auctions[51]

A Wetland Trade-off – to drain or not to drain: A wetland may be drained for agriculture or maintained for its water flow regulation / filtration / carbon sequestration and/or biodiversity. Draining the wetland will result in loss of asset value and flows of services from the wetland due to a change in the condition of the asset, and potential disservices in the form of silt and sediment run-off. But the potential crops grown – or subsidies paid - will also provide a market value. Weighing up the value of both choices in the context of the wider landscape and short- and long-term policies can be assisted by NCA. Equally, NCA can be used to identify co-benefits. For example, carbon sequestration benefits as well as benefits for water quality (filtration of sediment and attenuation of ammonia), biodiversity, flood mitigation (natural water retention measures or NWRM) as a result of restoration of peatlands as an Irish wetland example. The opposite occurs in terms of peatland drainage / cutting - in terms of disbenefits and disservices - but with short term market value (benefit) for the cut peat.

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[50] https://ec.europa.eu/jrc/en/publication/enhancing-resilience-urban-ecosystems-through-green-infrastructure-enroute-progress-report
[51] https://www.catchments.ie/using-reverse-auctions-to-support-delivery-of-catchment-off-sets-in-wessex-uk/

Table 1. An overview of further potential applications with more detail in Table A5, Appendix I; these will be developed further as the natural capital accounts are built for each catchment area.

Relevant natural capital asset / service	Relevant agency / organisation	Potential NCA application	Potential policy link
Aggregates (geosystem service)	EPA; GSI	Valuation of mineral resources; trade-offs with other land use	Land use and land use change and forestry
Carbon stores	DCCAE; EPA	Map high carbon stores, sinks and sources; LULUCF reporting	Climate Action; CAP; Forestry; Peatland Strategy; Carbon Tax
Climate regulation (creating carbon sinks)	DCCAE; EPA	Where to restore carbon sinks; offset losses	Climate Action; CAP; Forestry; Peatland Strategy
Coastal protection	Local Authorities; NPWS; OPW	Reducing coastal erosion; managing coastal habitats	Natura 2000; Planning and Devt.
Energy (potential spaces for wind, solar, geothermal)	DCCAE; SEAI	Space for renewables	Climate Action; Energy
Flood mitigation	DHPLG; LAs; OPW; RAs	Flood prevention; NWRMs	Floods Directive; WFD; Planning and Devt.
Groundwater	GSI; Irish Water	Protection of groundwater	Drinking Water
Landscape	Heritage Council	Conservation of cultural and natural landscape features	Landscape policy
Marine food production	BIM; DAFM; Marine Institute	Sustainable development	MSFD; CFP
Habitat	ENGOs; NBDC; NPWS, LAs	Restoration planning; nature networks / conservation	Natura 2000; Birds and Habitats Directive; Wildlife Act
Planning	DHPLG; LAs; RAs	Urban and rural planning	Planning Framework Ireland; Regional and County Development Planning
Pollination	DAFM; Teagasc	Reducing pollinator decline	Pollinator Plan; CAP
Terrestrial food production	DAFM; Teagasc	Sustainable development	CAP; Natura 2000
Timber	Coillte; Forest Service	Sustainable development	CAP; Forestry
Water (drinking)	EPA; Irish Water; LAWPRO, National Federation of Group Water Schemes (NFGWS)	Protect and restore water sources	WFD; Drinking Water
Water	EPA; IFI; Irish Water; LAWPRO	Protection of fisheries; habitats	WFD; Natura 2000
Soil	DAFM; Teagasc	Protection of soils	Soils Directive

Chapter 4   NCA at catchment level in Ireland

> **KEY MESSAGE:** *Having a selection of different catchment types allows us to consider a range of issues in the Irish context, particularly through the lens of the pressures, policies and solutions required for ICM. Four catchments will be studied by INCASE, each presenting a particular scenario and a set of questions around land use, water, biodiversity and climate action in the context of human use, policy context and general environmental management.*

Integrated catchment management and catchment services

The main focus of the INCASE project is to apply NCA at the catchment level. The catchment unit is proposed as the delineation of the areas based on the principles of the Integrated Catchment Management Approach (ICM) applied by the EPA, and the Catchment Services framework (*see* INCASE Literature review, Chapter 6). These approaches have many parallels with NCA and specifically the SEEA approach.

Working from both the top down and bottom up the **ICM framework fits with the systems and systems-thinking approaches**, while the catchment services concept links two components of natural capital (ecosystem and geosystem services) with social and economic services provided by people living in the catchment. This is the approach taken in preparing RBMPs as part of the implementation of the WFD, recognising otherwise hidden values and services provided by the catchment, and the integral relationship between the catchment and people. It promotes an integrated management approach – bringing land cover and land use topics such as biodiversity, agriculture and water quality together, in a similar way to NCA.

INCASE catchment selection

Four catchments were selected for the INCASE project to reflect the range of characteristics of land and water (biological, physical, chemical) such as soils, climate, bedrock, aspect, and altitude, as well as habitats, land uses and pressures in Ireland as identified in the RBMP 2018-2021 (farming, forestry, energy, infrastructure, industry, human settlement, rural development, urbanisation, etc.). The main considerations for catchment selection are listed in Table A1, Appendix I, with the following aspects highlighted by the EPA Catchments Unit:

- The accounts to be built around reliable datasets available nationally to allow for national scaling up;
- Consider catchments that capture the flow from 'mountains to sea';
- Consider stakeholder engagement and synergies / linkages with existing projects to maximise data inputs and opportunities for wide ranging stakeholder engagement.

The four catchments selected are (*see* Figure A1, Appendix I):

- *Caragh, Co. Kerry:* largely a peatland catchment and an important nature conservation area with focus on range of species including freshwater pearl mussel.
- *Bride, East Cork:* largely an agricultural catchment. Agriculture, urban diffuse pollution, forestry, hydro-morphological changes and wastewater treatment facilities are significant pressures in this catchment.
- *Figile, East Offaly:* considerably impacted by the peat extraction industry, there is large-scale transition towards renewable energy sources as well as peatland rehabilitation in this catchment.
- *Dargle, Co. Wicklow:* the catchment is a mix of expanding urban settlement, agriculture, forestry, moorland / heathland and peatland.

Chapter 5   Conclusions and recommendations

> **KEY MESSAGE:** *A logical framework has been outlined for the INCASE project to proceed, following an iterative process of data collation, analysis and stakeholder engagement. INCASE will provide the basis for the adoption of NCA as a normalised activity in Ireland building on previous and existing work to enable and inform integrated, inter-sectoral decision making.*

Aims and approach of the project – are they sufficient?

Much of the work completed in countries to date (consider the UK Natural Capital Committee (UK-NCC[52]) and the UK ONS[53] work, the work of the EU MAES and KIP-INCA projects) take the same approach as outlined in the INCASE project. In terms of NCA, key motivations of the INCASE project reflect those of the EU KIP-INCA, MAES and MAIA projects, and are to:

- Build on and **bring value to work completed to date** (bringing data-sets together from wide-ranging agencies and research projects);
- Collaborate with and **strengthen synergies** with existing projects, *while working to*
- Build **a shared platform of information** whereby a standardised and coherent information set on natural capital (extent, condition assessment, services and benefits) can be aligned with national accounts, *and*
- **Inform future standardised approaches** to data collection, data sharing and effective data use and reporting, *by*
- Establishing the **process steps for NCA** at catchment level, identifying challenges and developing solutions.

INCASE steps – informing the process

NCA is essentially a network of activities (*a system*) that are set out in a number of steps merely to group the tasks and process steps against a targeted outcome at each step (consider the SEEA-EEA accounts, *see* Figure 3). Establishing a clear process in the Irish context – considering data, people and applications – is fundamental to INCASE. Following the **standard approach to NCA** as outlined in Chapter 6 of the INCASE Literature review (Appendix II), the INCASE project will use **an approach of reflexive realism**, focusing on a close link between theory (the guidance notes and previous case-studies) and quantifiability in a process of iteration. The key steps for INCASE are:

- *Data:* carry out a review of data quality and potential for use in WP2/3; establish data share agreements; build a data platform / process whereby the process is mapped clearly;
- *Asset extent:* develop maps of extent and type of natural capital assets in each catchment;
- *Condition*: explore data available (quality and reliability) for use as condition indicators and to map pressures for each asset, in each catchment;
- *Services*: link maps and supporting data on asset extent, type and condition to identify services and flows of services within each catchment;
- *Benefits*: link data (what can be used and what sources?) on benefits and beneficiaries with activities in each catchment (WP2/WP3);
- *Policy relevance*: work with stakeholders at each step to clarify and ensure relevance / focus of the research and fit-for-purpose outputs.

Each of these steps must be considered against the backdrop of the specific character and questions of each catchment, but also in the context of how the process can be developed and refined in the national context. This is clearly a learning process as it is work that is pioneering, requiring feedback

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[52] https://www.gov.uk/government/groups/natural-capital-committee
[53] https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/uknaturalcapitalaccounts/2019

loops with stakeholders (local and national) and decision makers at every level and in each iterative step.

Establishing the core accounts as outlined in the SEEA-EEA, combined with knowledge of the pressures and management issues in a particular area (following from the ICM approach), will direct and inform discussions around how best to use the outputs to integrate policy development and land use, as well as informing potential trade-offs (including consideration of disservices and co-benefits) specific to an area / catchment. Linking the outputs of the SEEA-EEA with the work by the CSO on the SEEA-CF will help to build a broader, richer picture of the catchment from a natural capital accounts perspective and maintain relevant focus.

Working through challenges

There will be challenges for INCASE, as recognised by the Project Team and Steering Committee, and these range from high level epistemological questions to focused questions around data sharing, data quality and suitability. INCASE is **an essential and prudent step in 'learning by doing'**, working through challenges at a catchment level, to inform how NCA can be effectively and efficiently scaled up to national level. Certain aspects of NCA may only be appreciated at catchment scale, and not feasible at national scale, and *vice versa*. This is the **value in 'doing the learning' within INCASE**. Some of the challenges highlighted here[54] are generally common to other projects across the EU and globally in applying NCA:

- *Data*: is the quality of **data** at catchment level enough? What about national level – will catchment learnings be relevant? Where will data be stored? How can it be continually maintained and updated?
- *Condition indicators*: What metrics exist for the range of natural capital assets? Are we measuring what is required in 2020 to develop condition accounts? What about beyond 2020? What cross checks can we use for indicators in general?
- *Valuation*: what is the best approach? Whose value is important? What data is available and who sets the benchmarks for assets and services where no market exists? What are the consequences of creating market values around nature?
- *Decision making*: developing a transparent NCA process and valuations[55] - how can NCA inform decision making? Who makes the decisions?
- *Relevance*: making NCA policy relevant and not 'just another system'? How best to make NCA value adding (bringing efficiency and effectiveness to data use and relevance)?
- *Linking with the SNA*: can NCA inform sustainability indicators? Can nature be reduced to one number or indicator? How do we go *Beyond GDP[56]*? Can NCA help?

Setting out the challenges for INCASE creates an awareness of potential shortcomings and considerations for building NCA to suit the Irish context. The ongoing revision of the SEEA-EEA is exploring these issues with input from those working on NCA in the EU and wider areas. INCASE may identify further **issues specific to Ireland**, which may or not arise in other countries. This is of significance in relation to the ongoing work by Eurostat and the UN SEEA-EEA revision process to develop guidance for national statistics offices.

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[54] Challenges raised by Irish stakeholders to date include data quality, transparency of process, valuation, policy linkages, and applications; *see* Appendix I, Table A5.
[55] Different sectors and communities operate different value systems which need to be considered.
[56] https://www.oecd.org/social/beyond-gdp-9789264307292-en.htm

Feasibility of the INCASE project

> **Key Message:** *Developing the INCASE project for the selected catchments will fulfil the main objective of INCASE, which is to develop a framework whereby NCA can be implemented at catchment level, providing learnings and insight as to how to apply NCA at national scale. Potential applications will be developed for different sectors (climate action, agriculture, etc.) over the course of INCASE.*

The INCASE Project is considered feasible, at catchment level, based on considerations of the following:

- The structure and support of an expert, experienced and multi-disciplinary Project Team and Steering Committee;
- A strong motivation based on a number of policy drivers at international and national levels;
- An awareness from the outset of challenges posed for the project;
- The range, standard and quality of data (based on a preliminary review) available to construct the accounts at catchment level;
- The technical expertise in different agencies supporting the project in relation to technical and policy aspects;
- The support of a range of stakeholders locally, nationally and internationally.

The Project Team proposes that the **INCASE Project proceeds as outlined** in the original project proposal. Working at the catchment level, INCASE will apply the SEEA method, collaborating with stakeholders (local and national) to drill into the detail of the four selected catchments. How NCA can work with ICM to **inform the story of pressures, policy and solutions within each catchment** will be determined by linking the natural capital accounts at catchment scale to water quality, highlighting the dependency of land use at catchment scale with environmental management in general. Lessons learned will **inform the scaling up of NCA to national level**.

Given the *EU Green Deal* and other policy instruments due in 2020 (EU Biodiversity Strategy and new CBD targets), Ireland will be well placed in terms of developing and agreeing the best approach for NCA in Ireland and the EU following from the learnings and outputs of INCASE. The INCASE project will help to position Ireland as **one of the leaders in NCA development** and thinking, securing a role in steering the approach adopted across the EU.